DOCUMENT RESUME

ED 191 270 FL 011 283

AUTHOR Edwards, Mary Louise
TITLE Phonological Processes in Fricative Acquisition. Papers and Reports on Child Language Development, No. 17.
INSTITUTION Stanford Univ., Calif. Dept. of Linguistics.
PUB DATE 79
NOTE 9p.

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Child Language; Cognitive Development; *Consonants; *Language Acquisition; Language Research; Language Skills; Linguistic Performance; Phonemes; *Phonology; Preschool Children; *Pronunciation; Psycholinguistics; Speech; *Verbal Development
IDENTIFIERS *Fricatives

ABSTRACT

The research reported here was carried out to help establish the normal course of fricative acquisition as a basis for comparisons with abnormal development. Three questions concerning phonological processes were investigated as part of a larger study of fricative acquisition: (1) the phonological processes that underlie children's fricative substitutions and omissions; (2) processes that are most widespread in fricative acquisition; and (3) whether or not processes are gradually limited and suppressed during acquisition. The subjects for the study were six monolingual English-learning children, four boys and two girls, who were between the ages of 1.5 and 2.3 when data collection began; all were from similar middle-class backgrounds. Five word positions were considered in analysis of the data: initial prevocalic, initial preconsonantal, intervocalic, final post-vocalic, and final postconsonantal. This study shows two areas in which current models of phonological acquisition are inadequate: specifically the indication of how many processes apply in normal acquisition or which processes are most widespread, and an account of the variable nature of process application. (AMH)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

STANFORD UNIVERSITY
PAPERS AND REPORTS ON CHILD LANGUAGE DEVELOPMENT

PRCLD #17 (1979)

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Eve W. Clark
Assoc. Prof./Editor
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

ED191270

PHONOLOGICAL PROCESSES IN FRICATIVE ACQUISITION[1]

Mary Louise Edwards
Linguistics Department
Stanford University

Introduction

Fricatives and affricates are difficult sounds for children. They are often acquired late by children who are developing language normally (Jakobson 1941/1968; Wellman et al. 1931; Templin 1957; Bricker 1967), and they are frequently involved in the articulation problems of children with delayed language development (Winitz 1969; Ferguson 1975). In spite of these facts, the acquisition of fricatives and affricates by children learning English is still quite poorly understood. Thus, the main purpose of the research reported here was to help establish the normal course of fricative acquisition as a basis for comparisons with abnormal development. Three questions concerning phonological processes were investigated as part of a larger study of fricative acquisition:

1. What are the phonological processes (e.g. depalatalization) that underlie children's fricative substitutions and omissions?

2. Which processes are most widespread in fricative acquisition?

3. Are processes gradually limited and suppressed during acquisition, as Stampe (1969, 1973) claimed?

Procedure

The subjects for this study were six monolingual English-learning children, four boys and two girls, who were between the ages of 1;5 and 2;3 when data collection began. They were from similar middle-class backgrounds. Each child was seen individually between eight and twelve times over a period of seven months.

FL011243

During each recording session the child was encouraged to name and talk about a set of stimulus items (objects and pictures) that were especially chosen to elicit the ten "target" sounds in various word-positions. This gave a basic list of vocabulary items such as juice and shoes which contain at least one fricative or affricate in their adult form and which are likely to be familar to young children.

All sessions took place in a sound-treated room and were recorded on a high-quality reel-to-reel tape recorder, using a microphone concealed in a vest worn by the child. The narrow phonetic transcriptions of all fricative and affricate words from all 63 sessions comprise the data for this study. There are approximately 3400 target words (tokens) and 5000 target sounds in all.

In analyzing these data, I considered five specific word-positions:

initial prevocalic, initial preconsonantal, intervocalic, final postvocalic, and final postconsonantal. Phonological processes were formulated to account for all fricative substitutions and omissions made by each subject at each session. Wherever possible, a surface substitution was broken down into its "constituent processes." For instance, a substitution of [t] for /ʃ/ was accounted for by the operation of two separate phonetically motivated processes, depalatalization and stopping. In this study the term "process" is used basically as it has been used by David Stampe: A phonological process is a change that affects an entire class of sounds or sound sequence. For example, final devoicing is a process that devoices word-final voiced obstruents.

Results and Discussion

Phonological processes

In order to account for the fricative substitutions, omissions, etc. made by the six subjects in this study, it was necessary to formulate 33 phonological processes, some with more than one part. These processes include syllable additions and deletions, and segment additions, deletions, and reversals, as well as changes in point of articulation, manner of articulation, and voicing. Each subject exhibited between 24 and 30 phonological processes.

Widespread processes

The question of which processes are most widespread can be interpreted in several different ways. For instance, a widespread process may be one that is exhibited by many children. Of the 33 processes needed to account for the data in the present study, nineteen (58%) were shared, either completely or partially, by all six subjects. Thus, these nineteen processes are, in one interpretation, more widespread than the others.

In this study, other interpretations of "widespread" were also investigated. Two of these interpretations, which proved to be quite revealing, are discussed below. What I have called "process persistence" refers to the number of sessions at which a process applies, for one child or across children. "Process strength" refers to the number of instances in which a process actually applies, given the conditions under which it could apply. In computing process persistence and process strength, I counted only the first in a string of identical repetitions. For example, if a child substituted [d] for initial /ð/ in the word *that* ten times in one session, the substitute was counted just once under "stopping."

Process persistence. The six most persistent processes, across subjects, are listed below. The percentage of sessions in which each applied is indicated, and an example is given to illustrate each process:

Process	Percentage	Example
1. Stopping	100%	*jacket* [ˈdʒæk^{h}ɛt^{h}]
2. Depalatalization	94%	*fish* [t^{h}ɪs:ɪ]

3. Alveolarization (of interdentals)	92%	feather ['fʷɛ,zɚ]
4. Final Devoicing	84%	shoes [tʰuːsɨ]
5. Gliding	81%	"G" [dʲɪⁱ]
6. Dedentalization (of labiodentals)	78%	T.V. ['dɛɪβ̞ˌwɨɪⁱ]

Each of these processes was exhibited by all six subjects and was evident in over 75% of the total number of sessions. Stopping, the process that strengthens fricatives and affricates to stops, was the most persistent; it was evident in all 63 sessions. Depalatalization, which fronts palatal fricatives and affricates, was the second most persistent process, appearing in 94% of the total number of sessions (59). The alveolarization of interdentals also appeared in over 90% of the sessions. It can be hypothesized, then, that the six processes listed above are very likely to be found in normal fricative acquisition and to persist for a considerable amount of time, at least for children between about 1;6 and 2;6.

Process strength. Strength percentages were calculated for the six most persistent processes. Data were examined from just a few sessions for each child - the first one or two, the last one or two, and one or two in the middle of the recording period. At first, spontaneous and imitated forms were analyzed separately, but the two types of utterances were later combined because I could find no systematic differences in process strength between them.

Of the six processes examined, the strongest (across subjects and word-positions) were two point of articulation changes, depalatalization and the alveolarization of interdentals. Each of these processes applied in about 60% of the total number of cases in which it could have applied. This is shown in Table 1. The third point of articulation change, deden-

Table 1

Strength percentages for the six most persistent processes, across subjects and across word-positions

Process	Strength percentage
Depalatalization	64%
Alveolarization	59%
Final Devoicing	55%
Dedentalization	27%
Stopping	22%
Gliding	7%

talization of labiodentals, was much weaker, with a strength percentage

of 27%. Final devoicing applied in 55% of the possible instances, across subjects. Of the two manner of articulation changes investigated, stopping was much stronger than gliding (22% vs. 7%). It should be pointed out that the general strength order shown in Table 1 does not hold for each individual subject or for each word-position. For example, although stopping was much stronger than gliding overall and was stronger in initial position for all subjects, gliding was at least as strong as stopping in intervocalic position for half of the subjects.

The type of variation often found for one process is illustrated in Table 2, which contains the strength percentages for depalatalization

Table 2

Strength percentages for Depalatalization for each subject in each position (across sessions), and also across positions for each subject, and across subjects and positions

Subject	#_V	V_V	V_#	C_#	Across positions	Tokens
AE	83	78	100	100	86	44
JH	65	---	100	*100	76	29
SH	50	33	60	---	50	32
LB	61	75	60	50	61	36
CH	69	100	100	*100	80	41
KJ	39	*0	27	*0	35	54
Across Subjects	59	68	72	70	64	236

*Based on just one example.

for each subject in each position. If the data are pooled across subjects, depalatalization appears to be somewhat stronger in final position than in initial position, but there is variation among subjects. For instance, for LB depalatalization is strongest in intervocalic position, and for KJ it is strongest in initial position.

The situation with stopping is different in that there is more variation among positions but less variation among subjects. Stopping is much stronger in initial prevocalic position than in any other position across subjects and also for each individual subject. Across subjects, it applies in about 40% of the possible cases in initial prevocalic position but in only about 10% of the possible cases in final position.

Process limitation and suppression

In looking for evidence of process limitation and suppression, I examined data for two of the most widespread processes, depalatalization and stopping. In this part of the study, I again combined spontaneous and imitated forms because I could find no consistent differences in process application between them.

There was no evidence in these data for the total suppression of either process in any word-position, perhaps because of the relatively young age of the subjects, and there was no clear evidence of systematic limitation. However, the percentage of application of a process was often lower at the last session than at the first session for a child, indicating a general limiting. This is illustrated in Table 3. As this

Table 3

The percentage of application of Stopping and Depalatalization at the first two sessions and the last two sessions for each subject, across positions

Subject	Stopping		Depalatalization	
	First two sessions	Last two sessions	First two sessions	Last two sessions
SH	21%	11%	57%	17%
AE	16%	14%	88%	67%
KJ	29%	16%	60%	25%
CH	50%	30%	83%	70%
JH	23%	25%	65%	81%
LB	22%	32%	43%	77%

table shows, there was a decrease in percentage of application for both stopping and depalatalization between the early and late sessions for four subjects, but for the other two, JH and LB, there was an increase in percentage of application (although the percentages are close in some cases).

The results for depalatalization in initial prevocalic position only are presented in Table 4, which contains the percentage of applica-

---

Insert Table 4 about here

---

tion for each subject at each session. As Table 4 shows, when one position is considered by itself, the percentage of application is again lower at the last session than at the first session for four subjects, while for LB and JH the percentage is higher at the last session. However, there is a great deal of variation from session to session for all subjects. In other words, there is no steady decrease or increase with successive sessions.

To try to find clearer evidence bearing on the question of gradual limitation, I examined the details of both depalatalization and stopping in one word-position for two subjects. Even when each sound was considered separately, there was no striking evidence for the systematic and orderly limitation of either process. As an illustration, one small portion of the results (concerning LB's depalatalization of initial /ʃ/) is presented below. However, these results are representative of those found for

Table 4

The percentage of application of Depalatalization in initial prevocalic position for each subject at each session

Session	Subject					
	SH	AE	KJ	CH	LB	JH
1	50	92	75	---	30	---
2	50	71	*100	71	43	38
3	40	64	25	75	83	100
4	36	100	---	43	30	---
5	58	86	*100	88	50	67
6	50	100	25	67	40	75
7	71	43	13	86	100	42
8	44	50	67	56	75	33
9	13	33	50	--	100	55
10	0	57	*100	--	33	88
11	0	--	75	--	100	--
12	20	--	13	--	--	--
Tokens	99	88	59	52	68	57

*Based on just one example.

LB's renditions of initial /ʃ/

Session (age)	Substitutes	Target words	% of Depalatalization
1 (2;3,20)	$s^j \sim s^i{}_j \sim ʃ^j \sim ʃ$	shoes	50%
2 (2;3,20)	s	shirt	100%
3 (2;4,4)	t^h	shower	100%
4 (2;4,18)	$s^j \sim s$	shoes	83%
	$s \sim tʃ \sim {}^{s}tʃ$	sheep	
	ʃ	sugar	
5 (2;5,0)	$t{}^{s}s^j \sim s^j \sim ʃ^j$	shoes	50%
	ʃ	shirt	
6 (2;5,14)	ʃ	shoes	0%
7 (2;6,7)	$tʃ^j$	shoes	100%
8 (2;6,21)	s^j	shoes	100%
9 (2;7,4)	ts^j	shoes	100%
10 (2;7,18)	s:ʃ	shell	100%
11 (2;8,2)	s^j	shoes	100%
	s ~ s:ʃ	sheep	

other sounds, other subjects, and also other processes. As these data show, there is considerable variation in percentage of application among sessions. Moreover, in some examples there is complete depalatalization (e.g. an [s] substitute), while in others there is partial depalatalization (e.g. a substitute consisting of [s] plus a palatal glide), and in many cases other processes (e.g. stopping) apply in combination with depalatalization. Initial /ʃ/ is produced correctly once at the first session, and once at sessions 4, 5, and 6, but it is still depalatalized quite frequently throughout the period.

This type of variation, which was very common in the present study, is usually not discussed by phonological theorists, and no existing phonological model predicts it. In fact, Stampe (1973:5) states explicitely that such "indecision regarding which substitutes to use" occurs rarely, if at all. However, the variation in process application found in this study can be accounted for if several interrelated factors are taken into consideration:[2]

(1) First, several different 'competing' processes (e.g. deletion and depalatalization) may affect a particular sound. Therefore, the application of one process may increase with the loss of a competing process or the loss of a word in which a competing process applied.

(2) Second, a sound in one particular word may undergo a variety of processes, applying singly or in various combinations. Thus the production of that sound may vary considerably, even in one word, and correct production may occur along with different types of substitutes. (See, for example, LB's renditions of initial /ʃ/ in the word shoes.)

(3) Third, each lexical item may have its own 'history', following its own path, and progressing at its own rate. (For instance, compare LB's shirt at sessions 2 and 5 with sheep at sessions 4 and 11.) Because of this variation among words, a process may apply more or less frequently, depending on the specific lexical items that are attempted at any given time.

(4) Finally, when new lexical items are added to a child's productive vocabulary, they usually undergo one or more of the processes that are already evident. Therefore, the processes that apply in the new words may increase in their application, while those that do not may decrease.

It is clear, then, that process limitation is not always as simple or systematic as has been suggested in the past. It does not seem to be the case, at least for fricatives, that a process first applies 'across the board' and then gradually applies to fewer segments or in fewer environments, as Stampe (1969:443) claimed. Factors like the ones I have just presented complicate the picture. However, these results may be related to the age range of the subjects in the present study (1;5 to 2;8). As children eventually have to suppress most of their phonological processes, data from older children might provide clearer examples of gradual limitation and suppression.

Conclusion

This study has important implications for models of phonological acquisition. Specifically, it has shown two areas in which current models are inadequate. First, no current process- or rule-oriented model of phonological development includes any indication of how many processes apply in normal acquisition or which processes are most widespread. Second, no existing phonological model accounts directly for the variable nature of process application. Future research should investigate these two areas in more depth and should look for evidence bearing on the validity of the factors proposed here to account for the variation in process application.

Notes

[1]This research was supported in part by the National Science Foundation, Grant Number GS 30962, and in part by a fellowship from Stanford University.

[2]Word-position, which is also an important factor in process application, at least for fricatives, is discussed at length in Edwards 1978.

References

Bricker, W. (1967). Errors in the echoic behavior of preschool children. J. Speech Hearing Res. 10: 67-76.

Edwards, M.L. (1978). Word-position in fricative acquisition. Paper presented at the Third Annual Boston University Language Development Conference, Boston, Mass., September.

Ferguson, C.A. (1975). Fricatives in child language acquisition. Proceedings of the Eleventh International Congress of Linguists. Bologna-Florence, 647-64. (Earlier version in PRCLD 6: 1-60, 1973.)

Jakobson, R. (1941/1968). Child Language, Aphasia, and Phonological Universals. (Trans. from Kindersprache, Aphasie und allgemeine Lautgesetze. Uppsala, 1941.) The Hague: Mouton.

Stampe, D. (1969). The acquisition of phonetic representation. Papers from the Fifth Regional Meeting, Chicago Linguistic Society, 443-54.

_____. (1973). A dissertation on natural phonology. Unpublished Ph.D. dissertation. University of Chicago.

Templin, M.C. (1957). Certain Language Skills in Children. Minneapolis: University of Minnesota Press.

Wellman, B.L., I.M. Case, I.G. Mengert, & D.E. Bradbury. (1931). Speech sounds of young children. Univ. of Iowa Studies in Child Welfare 5(2).

Winitz, H. (1969). Articulatory Acquisition and Behavior. New York: Appleton-Century-Crofts.